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Review Paper

Assessment Role of Integrated Management of Fertilizer and Biofertilizer to Improve Corn Production and Achieve Sustainable Agriculture

Seyed Ata'ollah Siadat *

Professor, Department of Agronomy, Agricultural Sciences and Natural Resources University of Khuzestan, Ahvaz, Iran.

REVIEW ARTICLE

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ABSTRACT

Bio-fertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both, in association with plant roots and without it, insoluble soil phosphates and produces plant growth substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization. Chemical fertilizers are significant to succor nutrients in soil. Heavy doses of chemical fertilizers and pesticides are commonly used in order to enhance corn yields. Excessive nitrogen content in soil causes an inappropriate high uptake of this macronutrient by plants, which may result in inadequate growth and development due to the accumulation of nitrogen compounds in plant tissue. Growth prompting bacteria are including *Azotobacter*, *Azospirillum* and *Pseudomonas*. *Azobacter*, a free living and heterotrophic bacteria fixes nearly 20 to 40 kg nitrogen ha^{-1} and increases yield up to 50% 30. Combination fertilizer and biofertilizer also increases the rate of water and nutrient absorbance which raise the rate of growth and photosynthesis. These combination also increase the grain yield, yield components, and biological function, it has been found that bio-fertilizers can be combined with chemical fertilizers in a complementary way to reduce the excessive amount of chemical fertilizers used to grow corn. Applications of Nitroxin bio-fertilizer and chemical fertilizer (400 $kg.ha^{-1}$ urea with 300 $kg.ha^{-1}$ ammonium phosphate) had a significant effect on corn crop production. It seems according valid researchers consumption 150 kg Nitrogen ha^{-1} with 1 $L.ha^{-1}$ Nitroxin led to achieve maximum corn seed yield and it can be advice to producers. Also use 50% Urea fertilizer plus Nitrokara biological fertilizer and 50% Triple Super phosphate fertilizer plus potabavar-2 could be considered by researchers and farmers.

KEYWORDS: *Agrophysiology, Azospirillum, Azotobacter, Fertility, Nutrition, Yield.*

***Corresponding Author:** Seyed Ata'ollah Siadat ✉ Seyedatasiadat@yahoo.com

1. BACKGROUND

The use of renewable resources and inputs is one of the fundamental principles of sustainable agriculture that enables maximum crop productivity and minimal environmental risk (Kizilkaya, 2008). Management of the use of chemical fertilizers, especially nitrogen, is one of the most common and the most popular for crop research, because the deficiency and exacerbation of this element are both harmful (Murdock *et al*., 1997). Fertilizer management plays an important role for obtaining satisfactory yields and to increase crop productivity. Nutrient management may be achieved by the involvement of organic sources, bio fertilizers, and micro-nutrients (Singh *et al*., 2002). The impact of increased fertilizer use on crop production has been large and important (Hossain and Singh, 2000). More recently, attention is focused on the global environmental problems. The world elite society is giving emphasize on utilization of organic wastes, farm yard manure, compost, vermin compost and poultry manures as the most effective measure to save the environment to some extent. Organic materials are the safer sources of plant nutrient which have no detrimental effect to crops and soil. Cow dung, farm yard manure, poultry manure and also green manure are excellent sources of organic matter as well as primary plant nutrients (Pieters, 2005). After the industrial revolution widespread introduction of inorganic fertilizers led to a decline in the use of organic material in the cropping systems (Hasan uzzaman *et al*., 2010). Chemical fertilizers are significant to succor nutrients in soil. Heavy doses of chemical fertilizers and pesticides are commonly used in order to enhance corn yields. Excessive nitrogen content in soil causes an inappropriate high uptake of this macronutrient by plants, which may result in inadequate growth and development due to the accumulation of nitrogen compounds in plant tissue (Szulc, 2013). Studies have shown that long-term use of fertilizers reduces crop yields. This decrease is due to the acidification of the soil, the reduction of biological activity of the soil and the inappropriate physical properties of the soil (Alexandratos, 2003). Chemical fertilizers have several negative impacts on environment and sustainable agriculture. Therefore, bio fertilizers are recommended in these conditions and growth prompting bacteria uses as a replacement of chemical fertilizers (Wu *et al*., 2005). Growth promoting bacteria induced increasing plant yield as clone in plants root (Gholami *et al*., 2009). Growth prompting bacteria are including *Azotobacter*, *Azospirillum* and *Pseudomonas* (Banerjee *et al*., 2006). Tilak (1992) reported positive effects of double-inoculation of *Azotobacter* and *Azospirillum* on dry matter of maize and sorghum. To alleviate the problem, integrated plant nutrient management is an option as it utilizes available organic and inorganic nutrients to build ecologically sound and economically viable farming system. Research has suggested that integrated nutrient management strategies involving chemical fertilizers and bio-fertilizers enhance the sustainability of crop production. Integrated

plant nutrient management is the combined use of mineral fertilizers with organic resources such as cattle manures, crop residues, urban/rural wastes, composts, green manures and bio-fertilizers (Kemal and Abera, 2015). The application of bio fertilizers has become of great necessity to get a yield of sufficient high quality and to avoid environmental pollution (Shevananda, 2008). Biological fertilizers are obviously an important part of a sustainable agricultural system and have an important role in crop production by maintaining soil fertility (Chen, 2006). Biological fertilizers are produced from a variety of micro organisms that have the ability to convert nutrients from non-absorbable to absorbable forms (Yu and Wong, 2005). Bio-fertilizer usually contains microorganisms having specific function such as *Azospirillum* to fix nitrogen and P solubilizing bacteria to solubilize P from the soil and fertilizer to be available to the plants (Saraswati and Sumarno, 2008). Application of bio-fertilizers became of great necessity to get a yield with high quality and to avoid the environmental pollution (Shevananda, 2008). Among microorganisms, The *Azotobacter* has attracted more attention because of their ability to communicate with important crop plants such as wheat, corn, and sorghum (Hegde *et al*., 1999). *Azotobacter* is a free-living bacteria that stabilizing the molecular nitrogen for stimulating and enhancing plant growth through nitrogen fixation (Pandey *et al*., 1998), increasing the production of hormones (Hegde *et al*, 1999), B vitamins (Rao and Pillai, 1982), the development of the root system and the release of organic acids in the rhizosphere (Gaind and Gaur, 1989). Rai and Caur (1998) studied *Azotobacter* and *Azospirillum* and double-inoculation and alone inoculation effects on wheat growth and yield. Double-inoculation of *Azotobacter* and *Azospirillum* had positive effects on plant height, spike length, grain yield, biological yield and harvest index in various wheat genotypes. It is proved that hormones such as oxine, giberline and cytokenine are synthesized by many *Azotobacter* spp (Singh *et al*., 2004). The Nitroxin biological fertilizer also contains nitrogen stabilizing bacteria, which is produced and supplied with the approval of the country's research institutes (Asadi Kupaland and Isa Zadeh Laserjan, 2009). The bacteria in the Nitroxin biological fertilizer, in addition to stabilizing nitrogen of the air and balancing the absorption of macro and micronutrient elements, stimulate growth of the hormones by synthesizing and securing growth promoters such as hormones (Fulchirri and Frioni, 1994). Beyranvand *et al*. (2013) suggested that effect of nitrogen and phosphate biofertilizers were evaluated the positively, there were an increase in plant height, ear weight, and number of grain per cob, grain yield and biomass yield. Increasing yield was attributed to the plant growth promoting substances by root colonizing bacteria more than the biological nitrogen fixation, stated that yield increased due to promoting root growth which in turn enhancing nutrients and water uptake from the soil (Lin *et al*., 1983). Combined application of organic fertilizer and urea fertilizer or

combination urea fertilizer and polyamines significantly increased yield, vegetative growth and chlorophyll index (Zeid, 2008). For gave to highest seed yield in agriculture addition to both nitrogen and phosphate fertilizer is very important (Shaban, 2013). Yield is a complex feature which depends on the function of physiological combined processes in particular, the limiting components that change with the cultivar (Azarpour *et al*., 2014). Given the importance of nitrogen fertilization on the yield in grain from the corn plant, it is necessary to know what the best dose is for each variety as well as its influence on components of yield and other agronomic parameters in order to obtain better knowledge of said productive response. Physiological growth analysis is the important in prediction of yield. Growth analysis is a way to assess what events occurs during plant growth. Growth analysis is a suitable method for plant response to the different environmental conditions during plant life (Tesar, 1984).

2. OBJECTIVES

Current study was conducted to evaluate integrated effects of fertilizer and biological fertilizer on agrophysiological characteristics of corn crop.

3. EVIDENCE ACQUISITION

This research was carried out according assess results of valid researchers.

4. RESULT AND DISCUSSION

According to the Mohammed *et al*. (2001), the use of bio-fertilizers offers agronomic and environmental benefits to intensive farming systems in Egypt, and the data showed that using *Azospirillum* brasilense or commercial bio fertilizers in cereals with a half nitrogen rate (144 Kg N ha) caused a significant increase in yield. Further, seed inoculation with Rhizobium, phosphorus solubilizing bacteria, and organic amendment increased the seed production of the crop (Panwar *et al*., 2006). Nouraki *et al*. (2016) reported bacteria have positive role in the production of biofertilizers and hormones which play a significant role in regulating plant growth while mixing them with chemical fertilizers as a supplement the level and depth of the roots. This combination also increases the rate of water and nutrient absorbance which raise the rate of growth and photosynthesis. These combination also increase the grain yield, yield components, and biological function, it has been found that biofertilizers can be combined with chemical fertilizers in a complementary way to reduce the excessive amount of chemical fertilizers used to grow corn. It was shown that the mixing of biological fertilizers with chemical fertilizers could reduce the needs of chemical fertilizers up to 25% and these results are comparable to the application of 100% chemical fertilizers. Therefore, the best hybrid maze is the single cross 704 that has good yield potential when the chemical fertilizer is used at either 25% or 50% of the current application when mixed with the bio-fertilizer. Azimi *et al*. (2013) found that application of Super nitroplass bio-fertilizer with Phosphate barvar2 treatment has the highest seed yield (7.6 $t.ha^{-1}$) and non-

application of biofertilizers treatment has the Pishtaz cultivar has the lowest seed yield (6.3 $t.ha^{-1}$). Some researchers also have a significant increase in maize leaf area index of up to 120 kg N ha^{-1} combined with biological fertilizers (Mirshekari *et al*., 2009). Timoty (2010) reported the best situation was achieved through consumption of 120 $kg.ha^{-1}$ chemical fertilizers and the simultaneous consumption of Nitrokara, which could be considered by researchers and farmers. Tarang *et al*. (2013) reported applications of Nitroxin bio-fertilizer and chemical fertilizer (400 $kg.ha^{-1}$ urea with 300 $kg.ha^{-1}$ ammonium phosphate) had a significant effect on traits of root dry weight, number of seed per row (36.5), number of seeds per ear (458.56), 1000 seed weight, seed (13.23 $t.ha^{-1}$) and biological yield (26.4 $t.ha^{-1}$) , and harvest index (53.88%). Potals (2017) reported that the maximum plant height was produced in rice plant with the use of biological fertilizers with consumption of the 180 $kg.ha^{-1}$ nitrogen. Amanolahi Baharvand *et al*. (2014) reported integrated fertilizer (50% urea and 50% vermicompost) management improved corn growth, chlorophyll content and remobilization in corn plants. Soleimanzadeh and Ghooshchi (2013) reported biofertilizer had significantly effects on leaf chlorophyll, because inoculation with mycorrhiza increased the leaf chlorophyll (2.66 $mg.g^{-1}$ FW). Growth prompting bacteria are including *Azotobacter*, *Azospirillum* and *Pseudomonas* (Banerjee *et al*., 2006). *Azobacter*, a free living and heterotrophic bacteria fixes nearly 20 to 40 kg nitrogen ha^{-1} and increases yield up to 50% 30. Arsalan *et al*. (2016) investigated effect of different level of vermicompost (control and 2 $t.ha^{-1}$) on growth and nutrient uptake in mung bean and reported maximum seed yield, number of pod per plant and number of seed per pod and plant height was obtained from the use two $t.ha^{-1}$ vermicompost treatment and the least of these traits were obtained from control. Veisi Nasab *et al*. (2015) by evaluate the effect of different level of vermicompost on maize production reported the maximum harvest index (31.04%) was obtain from consume 12 $t.ha^{-1}$ vermicompost.

5. CONCLUSION

It seems according valid researchers consumption 150 kg Nitrogen ha^{-1} with 1 $L.ha^{-1}$ Nitroxin led to achieve maximum corn seed yield and it can be advice to producers. Also use 50% Urea fertilizer plus Nitrokara biological fertilizer and 50% Triple Super phosphate fertilizer plus potabavar-2 could be considered by researchers and farmers.

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FOOTNOTES

CONFLICT OF INTEREST: Author declared no conflict of interest.

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